MILL SECTION of

Concrete

Vol. 29 November, 1926 No. 5

Cement in 1925

FINAL figures for the cement industry for 1925 have been released by the United States Bureau of Mines and are presented elsewhere in this issue. They bring some very interesting facts to the fore.

Nineteen twenty-five set a new production mark with its 161,658,901 barrels—an increase of 8 per cent in production over 1924. With this increase in production came also an increase of more than 7 per cent in shipments of portland cement and the industry ended the year with the largest stocks of cement on hand that it has ever known.

Per capita consumption statistics also are indicative of the industry's progress. Ten years ago the per capita consumption of cement in the United States was only .83 barrels. In 1925 it had almost doubled with a figure of 1.40 barrels. Florida holds the year's record with a per capita consumption of 3.24 barrels.

Exports of cement during 1925 increased slightly over 1924, were about equal to 1923 exports and considerably below all previous years as far back as 1910.

Imports of foreign cement increased from 2,010,657 barrels in 1924 to 3,655,316 barrels in 1925—an increase of over 80 per cent and the largest amount ever recorded.

Six new cement plants came into production during 1925, which together with the increased capacity of existing plants, have raised the capacity of the industry to an estimated total production of 180,000,000 barrels in 1925. In addition, more than 20 new plants were in various stages of promotion or construction during that year. A production of 200,000,000 barrels is forecast for 1926.

There has been present during the 1925 period the beginning of a distinct tendency toward consolidation or grouping of plants with interlocking management. The present year, as shown by the news items published in almost every issue, show increased activity along these lines.

A great many of the new plants built and projected are located at points where water transportation facilities are available. There is also a tendency to locate the plants in or near large cities and to locate warehouses in other large cities so that a large market can be served by truck deliveries direct from the plant or from storage warehouses.

Improvements in manufacturing methods and equipment in the cement industry have brought the productivity of labor to new high standards, according to a study made by the United States Department of Labor. In the cement industry the output per man hour increased 57.8 per cent between 1914 and 1925.

During 1925 Canadian cement mills produced a total of 7,869,946 barrels of cement, an increase of 101,294 barrels over 1924 production. Shipments of Canadian cement also showed an increase totaling 8,116,597 barrels for 1924.

Production of portland cement in European countries in general showed increases even though in most of the European nations production capacity still exceeds the requirements of the domestic market.

Everywhere in the United States and abroad there was a decided indication of a revival of interest in scientific research, both in manufacturing technique and in the chemistry of cement. Great interest was manifested in the development of high early strength cements, in which European manufacturers have made significant progress.

Individual Research

BY the very nature of the work of chemists, mill superintendents and power plant officials in cement mills, questions and problems that require research are constantly arising. Comparatively little has been written and published on many of the subjects that engage the cement mill operating official's attention almost daily. He must needs dig into the subject himself and make his own investigations.

The value of these researches to the industry, if they were available to all plants, would be of inestimable value. Out of these seemingly minor studies there often develop truths and principles that are of fundamental importance. Practically every scientific discovery of fundamental value has been made by some individual, either conducting his own experiments or closely supervising the work of a few assistants.

In the matter of the uses of concrete, also, individual research has brought out many interesting and helpful facts. The subject of the use and manufacture of cements is so large and of such importance to everyone that any contribution to the general fund of knowledge on these subjects deserves encouragement. Such researches as these will supplement the larger, more highly organized efforts of the industry as a whole.

New Plant of Great Lakes Portland Cement Corporation Nears Completion

A Description of the New 7,000 Barrel Plant—Will Manufacture Lehigh Cement—Located Inside City Limits of Buffalo—Raw Materials—Plant Layout—New Ideas in Plant Design—Concrete Construction Used

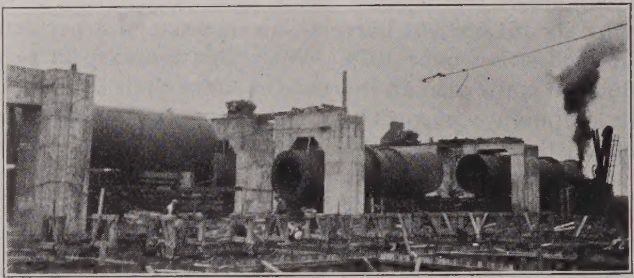
NOT more than three miles from Lafayette Square, the business center of Buffalo, the new plant of the Great Lakes Portland Cement Corporation is rapidly nearing completion. Under an arrangement with the Lehigh Portland Cement Company, the new plant will manufacture standard Lehigh cement. Present construction provides for a capacity of 7,000 barrels daily, but provisions have been made for increasing the output 50 per cent.

The design of the Great Lakes plant incorporated some new ideas that will eliminate much of the elevating machinery used in the average plant. In it, Adam L. Beck, President, and M. H. Hammond, Vice-President of the company, are working out some of the principles of plant design that they have acquired over many years of experience in cement plant construction and operation. All plant buildings and storage bins are being constructed of reinforced concrete.

Location

The new plant is being built on a tract of land lying between the Cleveland to Buffalo highway and the shore of Lake Erie and is on the north branch of the Union Canal on which its docks are located. It consists of about thirty acres, twenty-five of which will be occupied by the mill. The tract was purchased from the Pennsylvania Railroad and is in a rapidly developing industrial area. The transportation facilities are exceptional as the site is served by eleven steam railroads through reciprocal switching. In addition to these rail facilities, two electric railways that handle freight will be used for cement shipments. The plant has its own docks and will ship cement by water over the Great Lakes and the Erie Barge Canal.

Special provisions are being made to supply the local market by truck deliveries direct from the plant. Ohio State Road No. 5, the Cleveland to Buffalo Highway, passes directly in front of the plant. Over it truckloads of cement will supply the needs of the 1,500,000 people within a 35-mile radius of the mill.



Placing the coolers under the kilns.

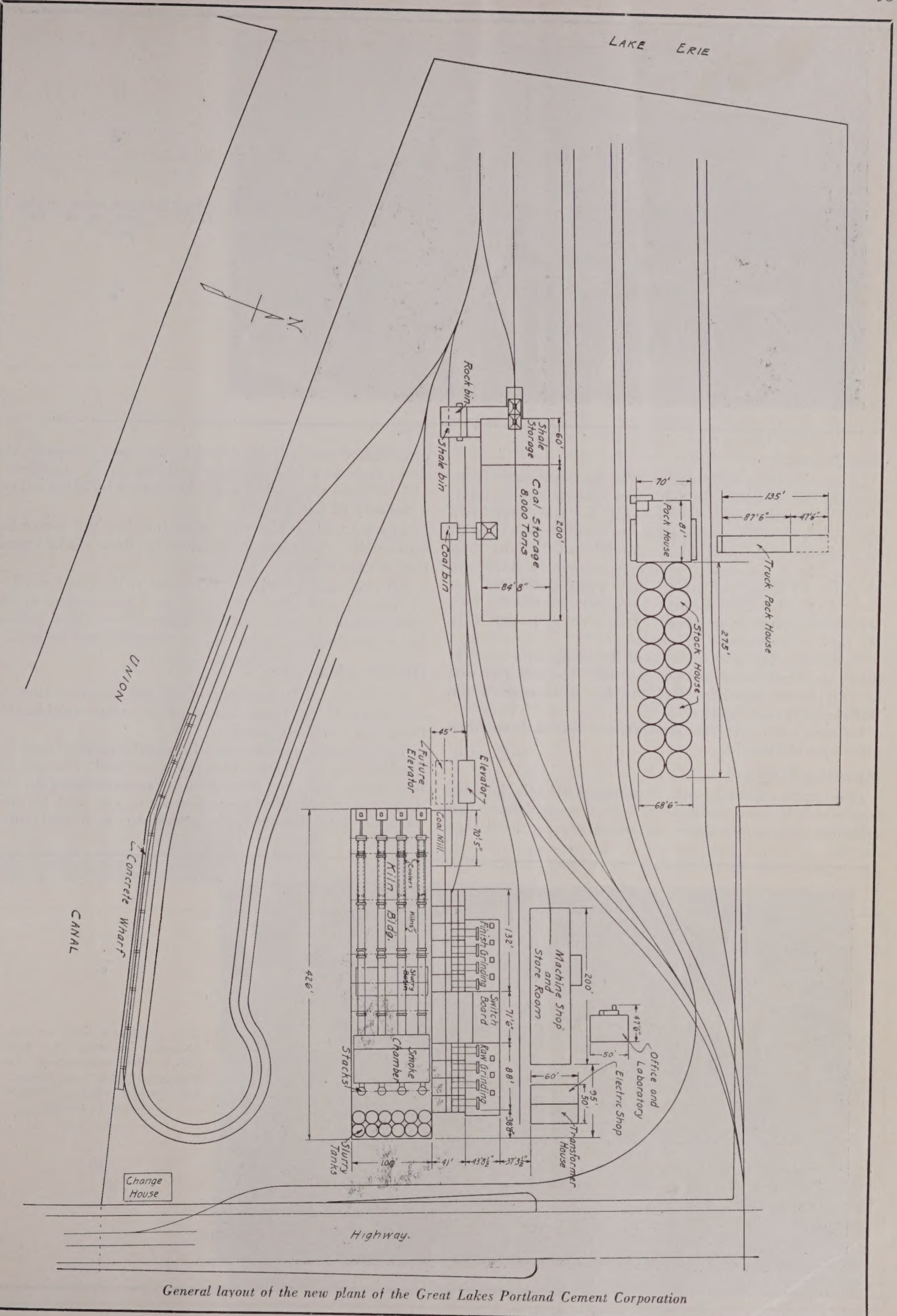
Loading Facilities

A special packhouse for truck loading is being provided adjoining the main packhouse. Six trucks can be loaded at a time and by means of automatic loading machinery, only five minutes will be required for loading a truck.

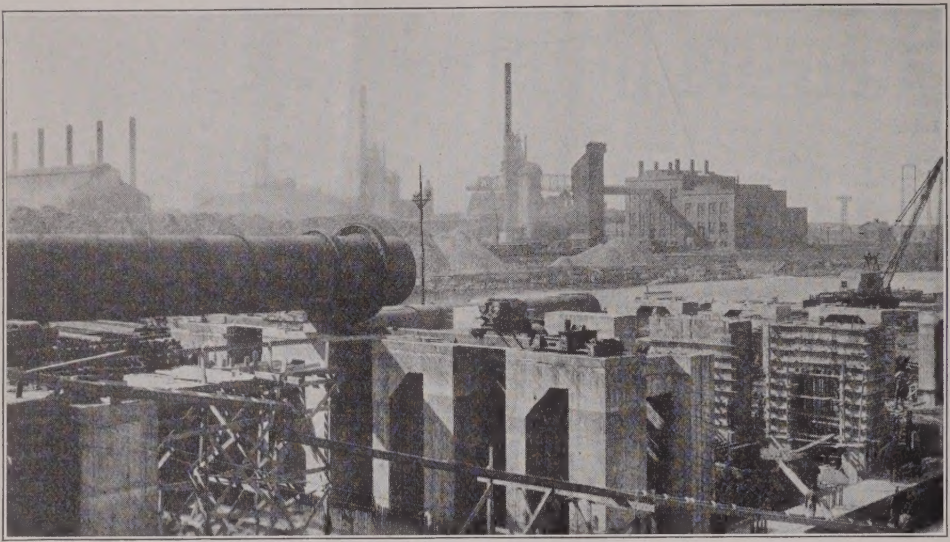
There are four railway sidings, two on each side of the main packhouse. Equipment is being installed that will permit loading ninety cars per day.

Lake freighters will be loaded at the company's own docks. A slip, extending from Lake Erie directly to the main packhouse, will provide facilities for loading barges.

General view of the northwest end of the property showing its location on Lake Erie.



General layout of the new plant of the Great Lakes Portland Cement Corporation



The first section of one of the kilns in place on the kiln piers.

Raw Materials

Limestones from Rogers City, Michigan, and shale from a nearby pit constitute the basic raw materials to be used.

The limestone will be shipped in lake freighters equipped with self-unloading devices from Rogers City, to be unloaded at the mill docks. As the dock is more than 600 feet long, practically unlimited storage facilities are available. Though the stone is now being purchased, the Great Lakes Portland Cement Corporation owns its own limestone deposits comprising 2,000 acres at Rogers City for future development, if needed.

Shale and clay will come from the company's own pit about eight miles southwest of the mill. The material will be shipped in gondolas and the pit is located in the Buffalo switching district.

Gypsum will come from the Oakfield district, twenty-two miles east of Buffalo.

Materials Storage

Ordinarily materials will be dumped directly into the bins above the raw mills as will be described later, but additional storage facilities for emergency use have been provided. Stone will be stored in the open alongside the dock, shale in a 60 by 85-foot building having a capacity of 3,800 tons and coal in a 200 by 85-foot building having a capacity of 8,000 tons.

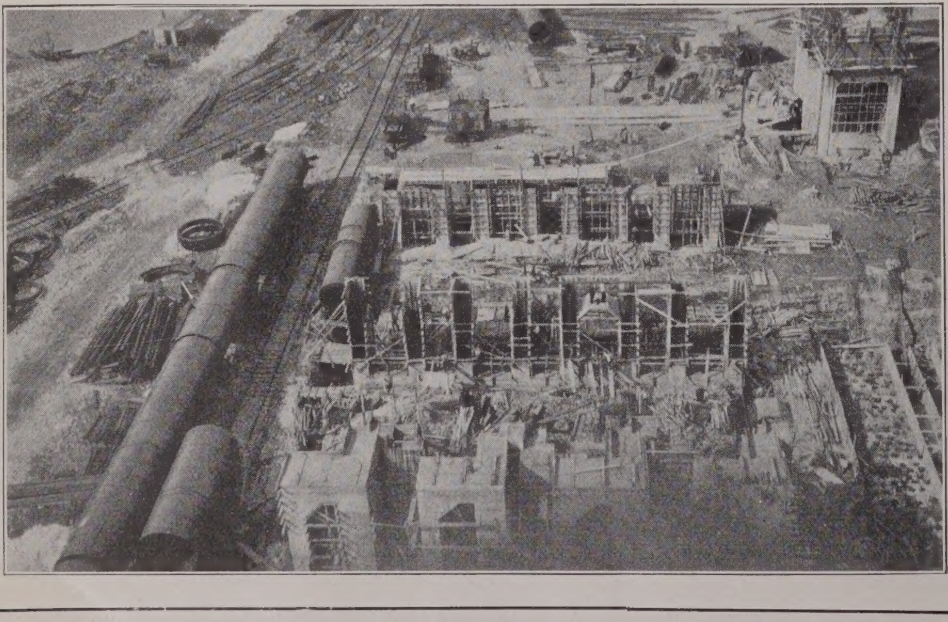
Gypsum will be placed directly into the bins above the finish mills, where storage facilities for three weeks' operation are provided.

All raw material will be delivered at the plant crushed to compeb mill size. The rock will be crushed at the quarries and the shale will be crushed by a Dixie pulverizer at the shale storage plant before going into the mill.

Handling Materials

It is in the initial handling of the raw materials that the procedure at the Great Lakes plant varies considerably from that ordinarily used.

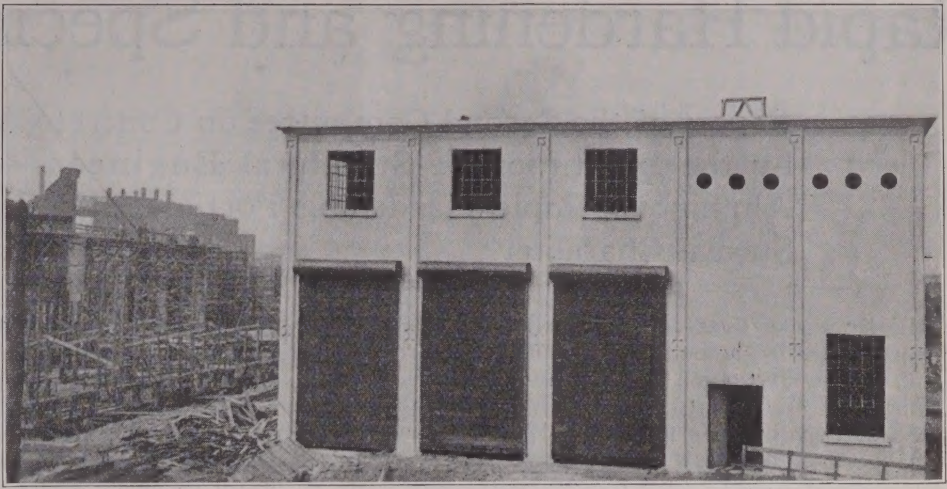
The company uses its own electrically-operated cars for handling the raw materials in the plant yard. Four motorized dump cars and two trailers, manufactured by the Atlas Car & Manufacturing Company, are used for this purpose. Into these the raw materials are loaded either

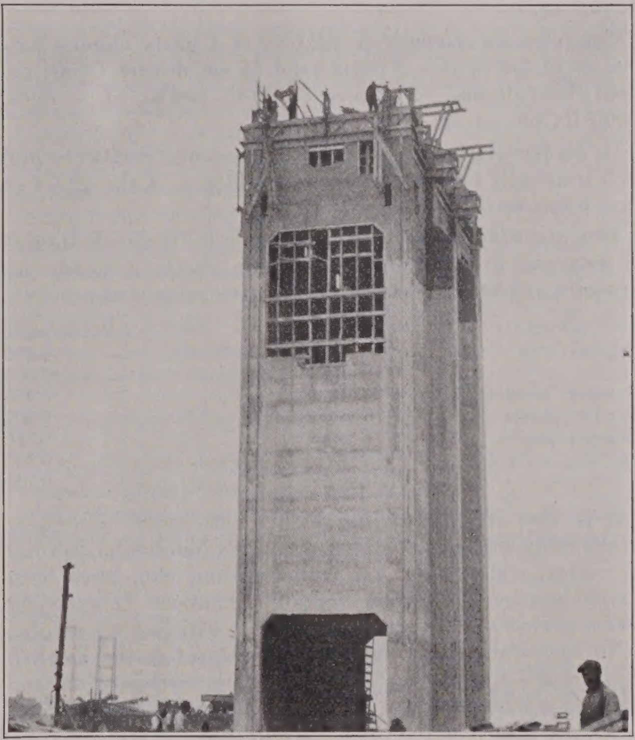


The southwest end of the property, showing the kiln piers under construction. In the upper right hand corner, construction on the elevator building is shown.

Side: The transformer building and electric shop.

Below: The car elevator under construction.





from dock storage, from the storage houses, or from the boats on which they are received. These cars then proceed to the elevator house where they are lifted bodily to a service track above the raw mill storage bins. A special elevator, capable of lifting the loaded cars to the service track 50 feet above the yard level, has been designed and manufactured by the Atlas Car & Manufacturing Company and will be installed in a concrete building, conveniently located between the storage buildings and the grinding buildings.

A service track, running over the bins serving the grinding department and the coal mill, will receive the dump cars from the elevator. The cars will then be spotted over the bins and dumped. The raw mill bins directly over the raw grinding mills, are of rectangular shape, built of reinforced concrete and have a capacity for 24 hours' operation. There are four bins for rock and four for shale, serving the four mills in the raw grinding department.

Raw End

The rock and shale feed directly from the bins into four 8 by 30 ft. Allis-Chalmers three-compartment compeb mills where the raw materials are ground. The compeb mills are operated by direct-connected 800-hp. supersynchronous General Electric motors. Thirty-one per cent of water is added to the material at the raw mills.

(Concluded on page 110)

Placing the concrete floor in the coal mill. In the background is the machine shop and store room.

Rapid Hardening and Special Cement

Report of the Second Committee on Concrete Appointed by the Institution of Structural Engineers — Covers Aluminous, Rapid Hardening Portland and Cements of Special Character

SOME interesting facts are contained in a report recently issued by the Sectional Committee on Concrete appointed by the Institution of Structural Engineers, London, England. The report, which is given below, covers portland and special cements and deals with the use of aluminous cement for structural purposes.

The principal cements, other than the well-known portland cements, at present on the market, which are of importance to the structural engineer, are: Aluminous cements, rapid hardening portland cements, slag cements (with and without added slag).

Aluminous cements differ materially from portland cements in their chemical composition. They usually contain from 30 per cent to 50 per cent of lime, 30 per cent to 50 per cent of alumina, and not more than 30 per cent to 50 per cent of silica, iron oxide and other constituents. They also differ in their physical characteristics. In appearance they are a very dark, almost black, powder, and, therefore, give a darker concrete than portland cements.

The principal advantage claimed for these cements is that, although they are as slow-setting as normal portland cements, yet they harden so rapidly that in 24 hours concrete made with them is as strong as it would be in two or three months.

It is claimed that aluminous cements are less susceptible to low temperatures during setting owing to the more rapid generation of heat due to chemical reaction than is the case with portland cements. And, again, that they are less susceptible to the action of sea water, acids, etc., than are portland cements.

The Question of Heat

Special attention is directed to the fact that in works of considerable thickness, where the heat generated is not rapidly dissipated by radiation, the temperature rise may be dangerous and requires careful consideration.

Even with 6 to 1 concrete using ordinary portland cement, a rise of 50 deg. F. has been recorded in work 8 ft. thick, and with aluminous cement much greater rises would occur under similar conditions.

It is not proposed to describe in detail the various methods of manufacturing aluminous cements, but it may be stated that whether made in blast furnaces or in rotary kilns the cost has hitherto been greater than for portland cements. This together with the fact that the principal raw material (bauxite) has to be imported, has necessitated a materially higher price to the consumer, which, apart from other considerations, has tended to restrict the use of the cement to those special cases where its peculiar properties counterbalance the extra cost.

Of the two well-known makes, "Ciment Fondu" is stated to have been first made in France in 1908, but it was ten years later before it was put on the market as a commercial article.

The manufacture of the English "Lightning" brand has only been established since 1924.

Tension and Compression

The former cement is believed to have been produced entirely in special blast furnaces, but "Lightning" brand has been manufactured in a rotary kiln as well as in a blast furnace. The following shows the strengths that can be expected from the aluminous cements mentioned above:

Tensile strength of mixture of 3 parts standard sand to 1 part cement—24 hours, 450 lb. per sq. in.; 7 days, 600 lb. per sq. in.

Compression strength of mixture of 4 parts Thames ballast ¾ in. to ¼ in.; 2 parts sand ¼ in. down; 1 part cement (by volume)—24 hours, 8,000 lb. per sq. in.; 7 days, 9,000 lb. per sq. in.

In contemplating the use of this cement, engineers and architects will naturally look for evidence of the effect of time upon work done therewith.

The manufacturers of "Ciment Fondu" publish figures of tests put in hand in 1916, which shows a steady increase in strength over a period of five years, viz.:

		Per sq. in. lb.
4 parts "Ciment Fondu" 9 parts gravel 3 parts sand	7 days	6,080
	28 days	7,695
	90 days	8,350
	6 months	8,900
	1 year	9,360
	3 years	9,490
	5 years	9,700

It is also stated that durability tests under extremely disadvantageous circumstances, such as immersion in tidal sea water, water saturated with gypsum, etc., have been carried out by the French Ponts et Chaussees Department over a period of 10 years with entirely satisfactory results.

No such data is yet available in respect to the English "Lightning" brand, but as its chemical composition and other characteristics are the same, there is no reason to anticipate that it will prove less durable.

Structural Work

The use of aluminous cement for structural purposes is, however, of so recent a date that its durability cannot yet be regarded as proven to the satisfaction of an engineer responsible for important constructional work.

All available tests show that it does not increase in strength to the same degree as portland cement, either relatively or actually. At 24 hours the aluminous cement concrete has acquired most of its ultimate strength and is very much stronger than Portland, but afterwards Portland steadily overtakes it.

At the present stage of the development of aluminous cements, therefore, the problem facing the structural engineer may be stated as follows:

Are the conditions of the work such that the advantages of getting extreme rapidity in the hardening of concrete or increased resistance to acids, etc., justify paying considerably more per ton for aluminous cement, with the added uncertainty as to whether the work will prove as durable as if constructed with portland cement?

Three interesting papers giving some details of the use of "Ciment Fondu" were read at the International Cement Congress in April, 1924.

Rapid Hardening Portland Cements

English portland cement manufacturers have during the last few years been devoting attention to the production of a portland cement having rapid hardening qualities, such as are possessed in so marked a degree by aluminous cements. A considerable amount of progress has been made in this direction, but no genuine portland cement has yet been produced to equal the aluminous cements in strength at early dates.

Tensile strength of mixture of three parts standard sand to one part cement—24 hours, 300 lb. per sq. in.; 3 days, 650 lb. per sq. in.; 7 days, 700 lb. per sq. in.

Compression strength of mixture of 4 parts Thames ballast ¾-¼ in.; 2 parts sand, ¼ in. down; 1 part cement (by volume)—24 hours, 1,500 lb. per sq. in.; 3 days, 3,800 lb. per sq. in.; 7 days, 4,300 lb. per sq. in.

Fineness—Residue on 180 by 180 mesh sieve, 1 per cent.

Notwithstanding this difference in strength, considerably more rapid hardening portland cement is being used than aluminous cement for three reasons—(1) the cost is very little more than that of ordinary portland; (2) the early strength developed is sufficient to meet the real necessities of most jobs; and (3) being a genuine portland cement, there is not the same feeling of uncertainty as to the permanence of work done therewith.

Should the development of portland cement along these lines succeed to any marked extent it may be found that the use of aluminous cement in England will not grow to very large dimensions. It suffers from the initial handicap that the bauxite has to be imported, whereas the best materials for the manufacture of portland are readily available in this country.

Blast Furnace Slag Cements

These cements were first produced in Germany, and can be divided into two main groups:

(a) Mixture of blast-furnace slag and portland cement clinker ground together—e.g., the English portland blast-furnace cement; the German Eisen portland zement (iron portland cement).

(b) Mixtures of blast-furnace slag and lime ground together.

(a) The English portland blast-furnace cement is the subject of a specification issued by the British Engineering Standards Association, No. 146, 1923. This permits of a cement containing an addition to portland cement clinker of not more than 65 per cent of granulated blast-furnace slag. The mixture being finely ground. The specification lays it down that it must comply with all the physical tests required of portland cement.

The German Eisen portland zement (iron portland cement), is also a mixture of portland cement clinker and granulated blast-furnace slag, but limited to the proportions of 70 per cent clinker to 30 per cent slag.

In Germany it is claimed that iron portland cement is superior to portland cement for sea water work, and, in fact, very large quantities are employed in all manner of important constructions.

It may be said that few, if any, works of first-rate importance or magnitude have been carried out, in this country, using cement of this character for the making of the concrete.

Mixtures of Slag and Lime

Whereas cements in group (a) are made with a proportion of true portland cement clinker, those in group (b) are slag cements pure and simple to which the term "portland" should never be applied.

Their manufacture in this country, at present, is very restricted, and extreme care would be necessary if their use was contemplated.

In conclusion it may be said that many other cements have been patented and produced under proprietary names, most of them laying claim to improved imperviousness to water when used in concrete making.

It is to be hoped that with greater knowledge of the art, and with greater experience, the concrete-maker will, in time, so adjust his proportions of materials as to always produce a strong, dense and impervious concrete without artificial aid.—*The Canadian Engineer.*

Output of Portland Cement in 1925

FINAL figures relating to the portland cement industry in 1925, compiled by the bureau of mines, department of commerce, show that the production of portland cement in 1925—161,658,901 barrels—was the largest quantity manufactured thus far in any year, exceeding that in 1924, the next highest year in production, by 8 per cent.

Portland Cement Produced, Shipped, and in Stock in the United States, 1924, 1925, by Districts

	Production					Shipments							Stock		
Commercial district	Active plants 1924	Active plants 1925	Barrels 1924	Barrels 1925	Inc. or dec. 1925 (pct.)	1924 Barrels	1924 Value	1925 Barrels	1925 Value	Avg. factory value per barrel 1924	Avg. factory value per barrel 1925	Inc. or dec. in quantity 1925 (pct.)	Barrels 1924	Barrels 1925	Inc. or dec. 1925 (pct.)
E'n Pa., N. J. & Md.	22	22	38,656,739	40,279,457	+ 4	37,989,250	$65,500,657	40,286,898	$70,094,072	$1.72	$1.74	+ 6	2,541,627	2,534,186	— .3
New York	9	9	7,571,856	8,769,584	+16	7,435,875	13,460,594	8,534,089	14,967,642	1.81	1.75	+15	792,831	1,028,326	+30
Ohio, W'n Pa. & W. Va.	12	14	14,331,451	15,572,602	+ 9	14,028,762	25,104,849	14,628,575	25,614,083	1.79	1.75	+ 4	1,369,916	2,313,943	+69
Michigan	15	16	9,259,781	10,936,181	+18	8,991,270	16,405,761	10,073,453	17,511,908	1.82	1.74	+12	1,060,047	1,922,775	+81
Wis.,* Ill., Ind. & Ky.	11	11	21,823,469	23,521,488	+ 8	21,343,396	37,189,604	22,052,884	37,792,110	1.74	1.71	+ 3	2,041,760	3,510,364	+72
Va., Tenn., Ala. & Ga.	12	14	11,411,054	13,505,792	+18	11,374,280	19,201,389	13,048,251	21,581,494	1.69	1.65	+15	491,474	949,015	+48
E'n Mo., Ia., Minn. & S. D.†	11	11	14,822,738	14,571,751	— 2	13,984,167	24,757,538	14,477,932	25,317,292	1.77	1.75	+ 4	2,737,240	2,831,059	+ 3
W'n. Mo., Neb., Kans. & Okla.	11	11	9,892,813	10,672,816	+ 8	9,586,984	16,262,422	10,524,247	17,772,268	1.70	1.69	+10	1,507,824	1,656,393	+10
Texas	5	6	4,565,983	4,858,212	+ 6	4,488,143	8,322,658	4,735,521	8,729,046	1.85	1.84	+ 6	356,212	478,903	+34
California	5	5	2,423,830	2,005,071	—17	2,377,774	5,081,599	2,018,034	4,388,453	2.14	2.17	—15	315,990	303,027	— 4
Colo. & Utah	10	10	11,615,379	13,098,140	+13	11,481,730	25,532,707	13,109,426	26,159,531	2.22	2.00	+14	502,584	491,298	— 2
Ore., Wash. & Mont.	9	9	2,983,016	3,867,807	+30	2,965,918	7,226,930	3,805,902	8,596,209	2.44	2.26	+28	434,190	496,095	+14
	132	138	149,358,109	161,658,901	+ 8	146,047,549	$264,046,708	157,295,212	$278,524,108	$1.81	$1.77	+ 8	14,151,695	18,515,384	+31

*Wisconsin began producing and shipping June, 1924. †South Dakota began producing December, 1924, and shipping January, 1925.

Shipments of portland cement from mills in 1925 increased 8 per cent in quantity and over 5 per cent in gross value. The average factory price per barrel in bulk in 1925 was $1.77, a decrease of 4 cents per barrel as compared with 1924.

Stocks at the mills also increased, reaching a total of 18,515,384 barrels on December 31, 1925, the greatest at the end of any year during which official records of stocks have been kept. They were about 31 per cent higher than at the end of 1924.

From reports of the producers showing mill shipments of portland cement into the various states estimates of per capita consumption in the accompanying table have been compiled. These are at best but approximations as they represent only the records of mill shipments into states; they do not include the imports, which would increase the consumption in states nearest the seaports and in certain states near the Canadian border, nor do they make allowance for a variable but considerable stock of cement at all times in transit, in warehoues at distributing points, and awaiting use at jobs.

Shipments of Domestic Portland Cement from Mills into States and Per Capita, 1924 and 1925, in Barrels[1]

State	1924 Total	1924 Per Capita[1]	1925 Total	1925 Per Capita[1]
Alabama	1,872,997	0.76	2,084,922	0.85
Arizona[2]	415,146	1.04	423,523	1.04
Arkansas[2]	1,084,020	.59	800,407	.43
California	10,846,703	2.73	12,433,619	3.09
Colorado	1,337,466	1.32	1,152,498	1.13
Connecticut[2]	1,582,312	1.04	1,758,443	1.15
Delaware[2]	385,581	1.65	401,923	1.71
District of Columbia[2]	722,960	1.47	886,236	1.78
Florida[2]	2,177,233	2.02	4,150,091	3.28
Georgia	1,408,106	.46	1,438,009	.47
Idaho[2]	262,422	.54	258,553	.53
Illinois	13,328,219	1.93	14,404,947	2.07
Indiana	5,522,818	1.81	4,997,971	1.63
Iowa	3,144,001	1.26	2,704,872	1.08
Kansas	2,142,725	1.18	2,257,447	1.25
Kentucky	1,763,538	.71	1,796,397	.72
Louisiana[2]	1,260,231	.67	1,100,099	.59
Maine[2]	386,593	.49	333,829	.43
Maryland	1,989,182	1.30	2,127,479	1.38
Massachusetts[2]	3,359,553	.82	3,418,028	.83
Michigan	9,355,024	2.28	9,564,976	2.31
Minnesota	3,248,369	1.28	3,615,328	1.41
Mississippi[2]	527,046	.29	579,239	.32
Missouri	3,985,049	1.15	5,600,510	1.62
Montana	202,782	.32	235,525	.36
Nebraska	1,499,998	1.11	1,674,944	1.24
Nevada[2]	91,821	1.19	100,997	1.30
New Hampshire[2]	378,554	.84	426,138	.95
New Jersey	6,410,037	1.84	7,082,207	2.02
New Mexico[2]	231,970	.61	181,927	.48
New York	17,456,377	1.58	18,488,762	1.66
North Carolina[2]	2,999,559	1.09	3,024,621	1.10
North Dakota[2]	248,732	.36	341,841	.50
Ohio	9,262,652	1.48	9,221,005	1.46
Oklahoma	2,210,586	1.00	2,377,673	1.06
Oregon	1,211,462	1.44	1,318,163	1.56
Pennsylvania	12,964,163	1.40	14,932,787	1.60
Rhode Island[2]	608,355	.96	711,391	1.05
South Carolina[2]	570,631	.32	864,166	.49
South Dakota[3]	466,725	.70	461,726	.68
Tennessee	1,558,825	.65	1,644,029	.68
Texas	3,853,698	.76	4,188,910	.82
Utah	427,825	.88	381,018	.77
Vermont[3]	300,102	.85	217,286	.62
Virginia	1,701,408	.70	1,648,744	.67
Washington	1,730,483	1.18	2,427,263	1.64
West Virginia	1,661,042	1.05	1,487,663	.93
Wisconsin	4,515,256	1.62	4,105,100	1.47
Wyoming[2]	331,309	1.51	225,170	1.01
Unspecified	59,899	-----	59,272	-----
	145,061,545	1.29	156,117,674	1.38
Exports reported by manufacturers, but not included above[4]	986,004	-----	1,177,538	-----
Total shipped from cement plants	146,047,549	-----	157,295,212	-----

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[1] Per capita figures based on estimate of population made by the bureau of the census.

[2] Non-cement-producing state.

[3] South Dakota began shipping, January, 1925.

[4] Includes shipments to Alaska, Hawaii and Porto Rico.

Portland Cement Manufacturing Capacity of the United States by Commercial Districts, 1924 and 1925

District	Estimated Cap'y (Bbls.) 1924	Estimated Cap'y (Bbls.) 1925*	P.C. of Cap'y Utilized 1924	P.C. of Cap'y Utilized 1925*
East. Penna., N. J. and Md.	43,831,000	43,607,000	88.2	92.4
New York	9,107,000	10,199,000	83.1	86.0
Ohio, West. Penna., W. Va.	16,289,000	18,994,000	88.0	82.0
Michigan	11,501,000	15,301,000	80.5	71.5
Wis., Ill., Ind., and Kentucky	23,532,000	26,091,000	92.7	90.2
Va., Tenn., Ala., Georgia	12,889,000	15,746,000	88.5	85.8
East. Mo., Ia., Minn., S. D.	17,675,000	18,942,000	83.9	76.9
West. Mo., Nebr., Kas., Okla.	12,202,000	13,240,000	81.1	80.6
Texas	5,175,000	5,830,000	88.2	83.3
Colorado and Utah	3,205,000	3,275,000	75.6	61.2
California	14,727,000	16,474,000	78.9	79.5
Ore., Wash. and Montana	4,967,000	5,692,000	60.1	68.0
	175,100,000	193,391,000	85.3	83.6

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*Subject to revision.

The total manufacturing capacity of all the active plants at the end of 1925 was 193,391,000 barrels, according to manufacturers' reports supplemented by a few estimates. This total, which is subject to revision, includes the annual capacity—about 5,800,000 barrels of finished portland cement—of six new plants that began operating during the year. They are located as follows: one each in Georgia, Michigan, Texas and Virginia, and two in Ohio.

A summary of the monthly estimates of output of portland cement in 1925, compiled from the monthly reports of producers, was published early in January, 1926, by the bureau of mines. These estimates, which indicated a production of 161,202,000 barrels and shipments of about 156,724,000 barrels, were within 0.3 and 0.4 per cent, respectively, of the final figures for 1925. The statistics here presented are based on revised annual returns from every active plant in the country.

1926 Canadian Lime Sales Below 1925 Record

The year 1926 will be recorded as one of the most unsatisfactory in the history of lime producing from the Canadian manufacturing viewpoint. The demand has been fairly good from the United States, but very weak from Canada. This is attributed to the economic slump which prevails in the eastern provinces, particularly. Building conditions have been at very low ebb, and there is little prospect of improved conditions. The lime manufacturers are forced to rely almost wholly on the demand from the United States, and this was below the volume registered in 1925. That year the demand for Canadian lime from Florida was exceptionally keen. Owing to the absence of a Florida building boom during last winter, shipments of lime from Canada to Florida since the inception of the year were about 40 per cent of the volume of 1925. If rebuilding programs are general in the hurricane and flood swept zones, there will be an increase in the demand for Canadian lime. Most of the manufacturers are carrying good sized stocks at present.

Power Plant and Kiln Design and Operation

A Series of Articles on the Combined Processes of Power Plant and Kiln Operation, Considered as a Unit

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Chemical Engineer
AND
T. H. ARNOLD
Electrical Engineer, Southwestern Portland Cement Company, Osborn, Ohio

Chapter II, Flues and Other Gas Passages

Some Considerations in the Design of Flue Systems for Cement Plants — Bringing Out Points Regarding Draft Losses, Separation of Dust from Hot Gases in the Flues, Radiation and Air Infiltration Losses

MODERN practice shows a decided trend toward larger sizes and capacities in the kiln units. The resulting increase in the quantity of gas to be handled does not appear to be realized nor does the variation in quantity due to wet or dry process or the class of fuel used, appear to receive the attention it should in the design of the flues.

Two general systems are followed in connecting the kilns and the boilers. Each kiln may be connected to its individual boiler, or all boilers and all kilns may be connected to a common flue. The first method has the advantage of simplicity in design and low cost, but necessitates a shut-down in case of trouble at either end. The latter arrangement is extremely flexible and allows the use of any combination of kilns and boilers by opening or closing dampers. It is more expensive to install, requires more space, and gives more opportunity for the infiltration of air and for radiation. If properly designed, the common flue will be justified on the grounds of continuity in operation. By-pass stacks may be installed with either system to avoid kiln shut-down in case of boiler trouble.

The effect of an otherwise excellent installation may be marred by faulty design of the gas passages. The main points to be considered in the design of the flues are:

1—Ample area to allow proper velocities for the amount of gas to be handled with a minimum of draft loss.

2—Proper ratio of height to width to allow economic construction with maximum deposition of the dust and with adequate means for its removal.

3—Refractory lining and heat insulation to prevent excessive loss by radiation.

4—Outer protection to prevent accidental damage to the walls and to prevent the infiltration of air.

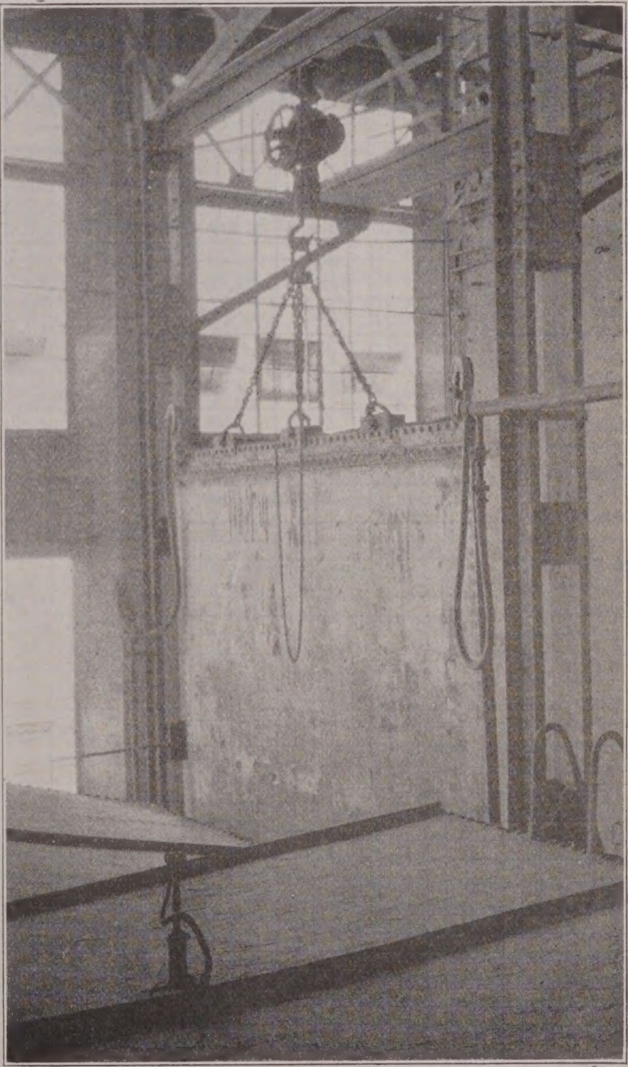
5—Mechanical construction to give stability to the structure and prevent settlement and cracking of the walls.

6—Design of the turns and dampers to give a minimum of loss at these points.

The rear housing and flues should receive the gases and transmit them to the boilers with a minimum of loss in heat or draft and should remove from them that portion of the dust which is detrimental to the fans and boilers.

Volume of Gases

The volume of the gases decreases throughout the system in proportion to the decrease in temperature as the heat is removed by the boilers and economizers. This decrease in gas volume is counteracted by the air infiltration through leaks in the boiler settings. The accompanying chart, No. 1, shows the volume required by one pound of



A water-cooled damper for boiler connections air at various temperatures from 0 to 2,000 deg. F. with accompanying table for converting to other gases.

Draft Losses

Draft losses in the flues and boilers are composed of two components. Dynamic losses are due to the changes in velocity and direction of the gases in passing through the system. The friction losses are due to the friction of the gas along the walls of the passages.

The draft in inches of water to produce the required velocity is:

$$p - p_1 = \frac{v^2}{335 \times \text{specific volume}}$$

Where $p - p_1$ is the draft in inches of water, v is the velocity in feet per second, and the specific volume is expressed in cubic feet per pound. The loss due to turns in direction of the gas is expressed in percentage of velocity heads and for rectangular flues will vary from 120 to 8 per cent for 90 deg. turns.

The friction loss is expressed by the formula

$$p - p_1 = f \times \frac{L}{D} \times q \times v^2$$

Where f is the friction coefficient, L is the length in feet, D is the diameter in feet, v is the average velocity in feet per second, d is the density of the gas in pounds per cubic foot.

For rectangular flues this becomes

$$p - p_1 = f\frac{L}{D} \times q \times v^2 \times \tfrac{1}{2}\left(\frac{D}{B} + 1\right)$$

where D and B are the sides of the rectangle.

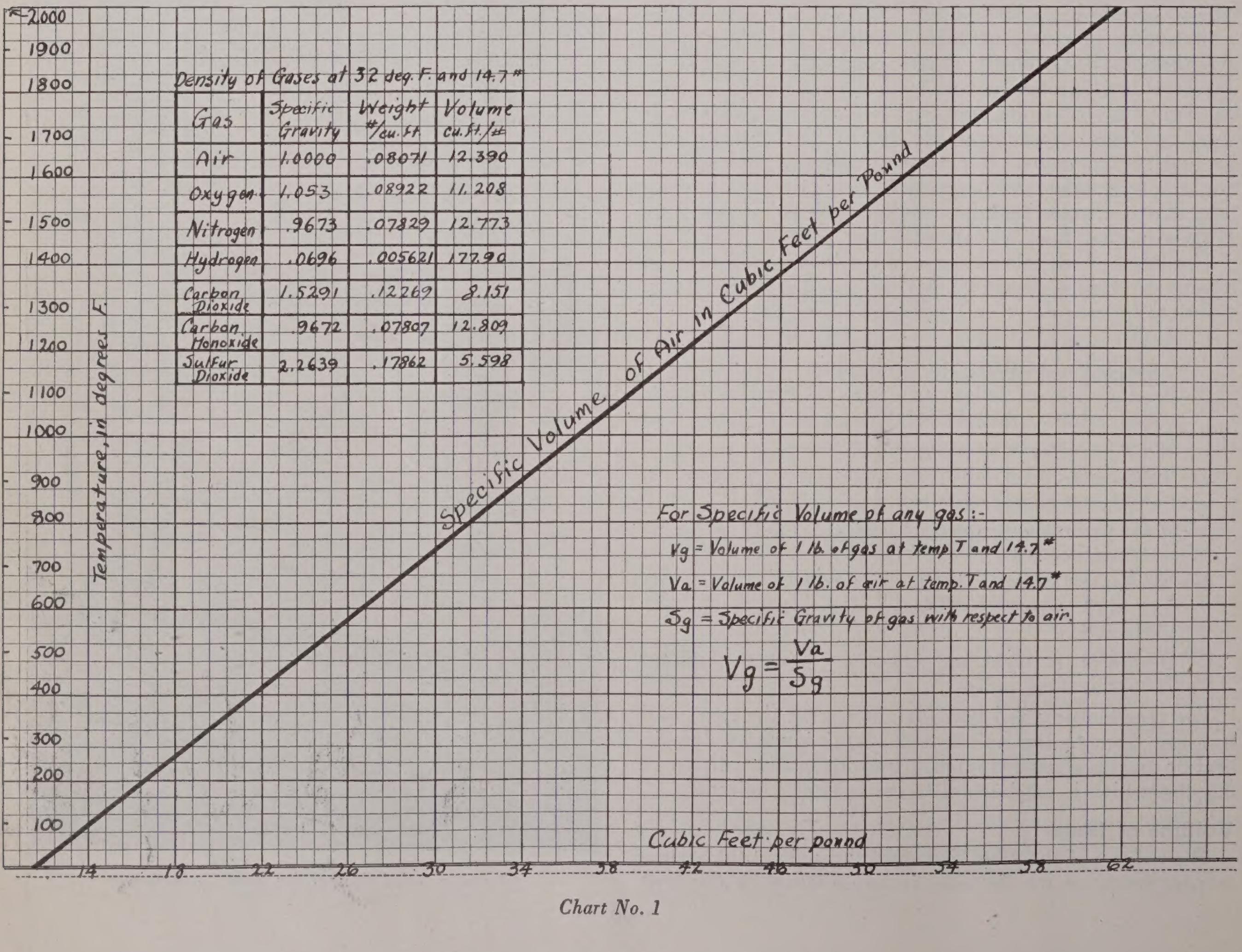
Various values have been given to the coefficient f. It would appear that the coefficient will not be a constant. Trinks (Industrial Furnaces) gives values of this coefficient as varying with the ratio $\frac{vD}{u}$ where v is the velocity in feet per second, D is the diameter in feet and u is the kinematic velocity in ft.^{2}/per sec. Thus allowing for the relation between the roughness of the walls, the size of the flue and the velocity of the gas. These relations are shown by charts No. 2 and No. 3.

The effect of the buoyancy of the gases in vertical passages must be considered in making the summation. This may assist or oppose the draft, depending upon the direction of the flow. To determine accurately the draft necessary, a study of the flue system in detail should be made. The power required by the fans will vary with the quantity of gas handled and with the draft required. It is therefore important to keep the weight of gas and the draft loss as low as possible.

Dust Collection

The dust carried from a cement kiln will vary from 3 to 12 per cent of the material fed to the kiln. This brings a considerable loss in the process and is objectionable for many reasons. It causes trouble in the boilers and fans from clogging of passages, interference with heat transfer and from erosion of the boiler and fan parts.

The time is fast approaching when the public will awake to the fact that it need not permit the nuisance of cement dust emitted from the stacks to destroy the vegetation of the surrounding country. The more advanced plants are installing dust collecting equipment to recover the dust at



Density of Gases at 32 deg. F. and 14.7#

Gas	Specific Gravity	Weight #/cu. ft.	Volume cu. ft./#
Air	1.0000	.08071	12.390
Oxygen	1.053	.08922	11.208
Nitrogen	.9673	.07829	12.773
Hydrogen	.0696	.005621	177.90
Carbon Dioxide	1.5291	.12269	8.151
Carbon Monoxide	.9672	.07807	12.809
Sulfur Dioxide	2.2639	.17862	5.598

For Specific Volume of any gas:-

Vg = Volume of 1 lb. of gas at temp T and 14.7#

Va = Volume of 1 lb. of air at temp. T and 14.7#

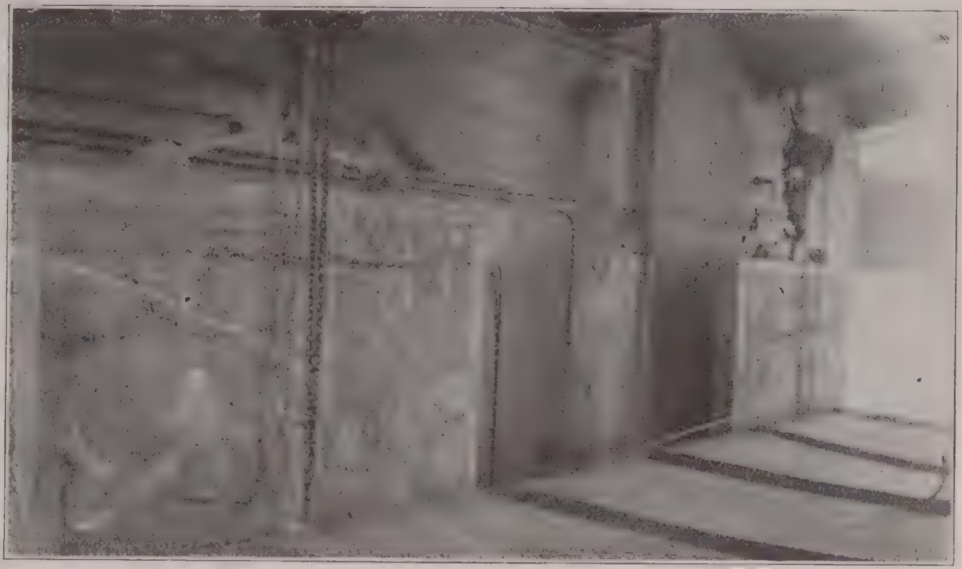
Sg = Specific Gravity of gas with respect to air.

$$V_g = \frac{V_a}{S_g}$$

Chart No. 1

all points throughout the plant. The Cottrell electrical precipitation system is a very practical method of removing the dust from the stack gases. The cost of operation increases rapidly with the amount of dust in the gases, thus the removal of a portion of the dust in the flues will result in lower cost of the final collection.

The logical place to remove the coarser particles of the dust is thus in the flues between the kilns and the boilers. By careful design this portion of the dust may be removed in the flues at low cost and returned to the kilns. The extreme fines remaining will cause little trouble in the boilers and fans.



Insulated dampers for cutting off kiln exits

Removing Dust from Hot Gases

Comparatively little accurate data is available on the removal of dust from the hot gases in cement plants. A large amount of experimental work along this line has been done by the smelters, and their general conclusions may be applied to the cement industry, although the specific gravity of smelter dust is higher than that of the cement dust. Liddell quotes the experiments at the Bingham Junction Smelter, which show that a gas velocity of 33 ft. per second will maintain lime dust in suspension. Hoffman quotes the experiments at the Copper Queen Smelter which show that all but the extreme fines will be deposited from a gas with a velocity of 2.5 ft. per second, in a distance of 125 ft. The customary velocity of the gas in the settling chambers in the smelters varies from 3 to 8 ft. per second.

Anderson (Transactions of the American Inst. of Chem. Eng. 1925) points out some of the principles and characteristics of dust particles suspended in gases.

One of the important characteristics of suspended matter which affects its separation and collection is that of size. There can, however, be no sharp dividing line, based on size. Particles which originally might be of molecular proportions, often grow fairly large by agglomeration. Ordinary cement dust may be a mixture of cement materials, coal ash particles and alkali fume. The agglomeration of fume and other particles and the entrainment of gases between such particles also introduces variations in the behavior of the suspended matter.

The fundamental factor in the separation of suspended matter by gravitational methods is the velocity imparted to the particles by the force of gravity or the rate of settling. The following formula is derived from Stokes Law:

$$v = \frac{gD^2d}{ku}$$

where v = The velocity of the particle in respect to the gas.
D = The diameter of the particle.
d = The density of the particle.
g = The acceleration due to gravity.
u = The viscosity of the gas.
k = A constant.

The theoretical values of this formula have been checked against the values with moving air. A further factor of .5 to .56 must be used if this formula is to be used with gases passing through flues.

Formula Application

The following problem will illustrate the practical application of this formula. Two designs of flue are proposed for a flue 39 ft. long, the analysis being as follows:

	Case 1	Case 2
Height of flue:	14 ft.	8 ft.
Velocity of gas:	13 ft. per sec.	25 ft. per sec.
Time of gas travel:	$\frac{39}{13} = 3$ sec.	$\frac{39}{25} = 1.56$ sec.
The velocity of settling of the slowest falling particle is then:	$v = \frac{14}{3} = 4.67$ ft. per sec. = 142.3 cm. per sec.	$v = \frac{8}{1.56} = 5.12$ ft. per sec. = 156.0 cm. per sec.
The diameter of the slowest settling particle is then:	$D^2 = \frac{142 \times .183 \times .00018}{981 \times 2.6 \times .56}$ $= .000\,003\,29$ $D = .001\,814$ cm.	$D^2 = \frac{156 \times .183 \times .00018}{}$ $= .000\,003\,61$ $D = .001\,90$ cm.

Where $k = .183$
$u = .000\,18$
$d = 2.6$
$g = 981$

It is thus apparent that the increased height of the flue in Case I will offset the increased velocity in Case 2 and the size of the particle and thus the amount of dust collected will be practically the same for both cases. The first step should be to determine the settling rate of the smallest particle desirable. After the settling rate has been determined a flue can be designed with appropriate cross section, height and length to insure that the desired proportion of the suspended matter will settle in the time required for the gases to pass through the flue. It is obvious that the flue should be as low as possible and the design should be such that the gases will have an even flow throughout the entire area of the flue.

Some other factors will assist in settling out the dust. The friction along the walls will cause a local reduction of the velocity in the gas in contact with the walls with a consequent deposit of the dust. A change in direction will cause the gases to impinge on the opposite walls with similar results.

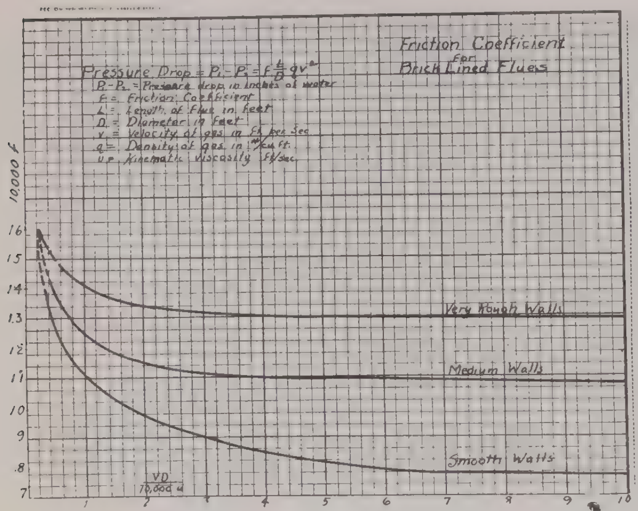


Chart No. 2

Flue Velocities

Present practices show little appreciation of these principles. Higher velocities are current, and many plants settle practically no dust between the kilns and boilers. Fan erosion has been eliminated and large quantities of dust have been collected where the velocities have been kept low.

From a practical standpoint it would appear advisable to keep the velocities in the flues below 10 ft. per second. With this velocity the flues should be designed with bottom as a series of hoppers. These hoppers should be equipped with dust-tight gates for handling the accumulation. The hot dust flows quite readily when disturbed, but when drawn from the bottom of a hopper will maintain an angle of repose of 60 deg. It is therefore advisable to use an angle of 60 deg. or steeper for the inside of the hoppers, to make them self-cleaning. One vertical side will assist in preventing bridging of the dust. The hoppers should be made of steel or concrete and lined in a similar manner to the flues.

A screw conveyor leading to an elevator will form a very convenient method for returning the dust to the kilns. This should be connected by a dust-tight casing to the hoppers. The hot dust, unless properly controlled, forms a serious hazard. All gates should be manipulated from a safe point for the operator.

Insulation

The temperature of the gases and the character of the dust will determine the thickness and composition of the refractory lining. Structural requirements and commercial sizes will limit the variation to commercial brick sizes for flues of this size. It is doubtful, however, if a refractory lining less than 9 in. thick will be practical and with a suitable heat insulator behind it, additional thickness will not be required. Unless this heat insulator is applied, much of the heat recovered will be lost in radiation from the large areas of the flue.

The general laws of heat flows are simple but few engineers apply them. The data on high temperature insulation show considerable variation between individual investigators. The data, however, probably do not vary be-

TABLE 1

Material	Density lbs. per cu. ft.	Spec. heat	*K* B.t.u. per sq. ft., etc.	r Thermal ohms per cu. in.	At temp. deg. F.	Authority
Alundum brick	127-149	———	7.26-4.03	37.5-67.7	1112	Randolph
Bauxite brick	118.0	———	9.41	29.0	1832	Randolph
Carborundum	128.0	———	40.8	6.69	2072	Randolph
Chromite brick	128.0	0.174	7.19-19.5	38.0-14.0	2072	Randolph
Concrete	170-180	0.20	6.38	42.8	———	McMillan
Feldspar	———	———	16.05	17.0	212	Randolph
Fire brick	111-178	0.253	10.1-12.4	27.0-22.0	2072	Randolph
Gas retort brick	———	———	11.03	24.7	———	Marks
Glass	150-170	0.18	7.00	39.0	———	McMillan
Glass	———	———	4.33	63.0	78	Randolph
Graphite brick	112.0	———	71.9	3.8	———	Randolph
Infusorial earth	43.0	———	0.583	468.0	77	Van Dusen
Insulbrix	36.0	0.19	0.84	325.0	1000	Quigley Fur Spec. Co.
Iron	480.0	0.118	420.0	0.65	———	Marks
Limestone	170.0	0.217	15.0	18.2	———	McMillan
Magnesia brick	125.0	0.324	17.05	16.0	2072	Randolph
Nonpareil brick	27.0	0.20	1.10	248.0	1600	Armstrong Cork Co.
Nonpareil brick	25.8	0.295	0.477	572.0	470	McMillan
Retort brick	116.0	———	10.95	24.9	2072	Randolph
Sand	110.0	0.195	2.70	101.0	———	McMillan
Silica brick	98.5	0.29	5.81	47.0	1832	Randolph
Silo-cel brick	30.0	0.225	0.67	407.0	470	McMillan
Silo-cel brick	31.0	0.2089	0.745	366.0	1600	Celite Products Co.
Silo-cel powder	12-15	0.2089	0.300	910.0	77	Celite Products Co.
White building brick	118.0	———	10.90	25.0	1832	Randolph
Asbestos fiber	12.5-18.7	———	.608-.497	448-548	932	Randolph
Asbestos mill board	61.0	———	0.833	328.0	———	Van Dusen
85% magnesia	13.5	———	0.455	600.0	0-750	Randolph
Mineral wool	12.5	0.198	0.275	993.0	77	Van Dusen
Mineral wool	26.6	0.198	0.479	570.0	932	Randolph

Many of the above are not heat insulators in the ordinary sense of the word but are given for comparison. *K* is expressed in B.t.u. per hour, per square foot, per inch of thickness, per deg. F. temperature difference.

yond the commercial variations of the material. The factors K and r are not constants but vary with the thickness and the temperature. The results given are sufficiently accurate for flue calculations. Table No. 1 was given by Woodston (Amer. Electro-Chemical Society, 1923). A wide variety of materials are available for heat insulation, but comparatively few are suitable for operating at the temperatures which prevail in waste heat work. Our modern heat insulators depend upon the principle of entrapping air in spaces small enough to prevent convection currents. The efficiency of a heat insulator is measured by the large number of minute air spaces and the small area of contact of the enclosing media which conducts the heat.

McMillan gives the following formula for flat surfaces:

$$Q = \frac{t_s - t_a}{\frac{x_1}{k_1} + \frac{x_2}{k_2} + \frac{x_3}{k_3} \cdots + \frac{1}{a}}$$

and for cylindrical surfaces

$$Q = \frac{t_s - t_a}{\frac{r_s \log_e \frac{r_2}{r_1}}{k_1} + \frac{r_s \log_e \frac{r_3}{r_2}}{k_2} + \cdots \frac{1}{a}}$$

Q = B.t.u. per sq. ft. per hr.
t_s = temp. hot surface deg. F.
t_a = temp. air deg. F.
x = thickness insulation in inches.
a = surface transmission factor.
k = B.t.u. per hour per inch per deg. F. difference.
r_s = radius of outer surface of insulation in inches.
r_1 = radius of outside of cylinder in inches.
$r_2 = r_1$ + thickness of first layer of insulation.
$r_3 = r_2$ + thickness of second layer in insulation.

The factor $\frac{1}{a}$ has not been accurately determined. It varies with different materials, the condition of the surface, and other factors. The value of 0.5 may be used for ordinary calculations for still air and a good grade of insulating material.

The outer casing has three purposes. It furnishes mechanical protection for the insulating material. It provides additional mechanical strength to resist the stresses in the brickwork. It also serves to seal the walls from the infiltration of air. This latter point is very important as the drafts and areas are much larger with waste heat boilers than with coal fired boilers. Air infiltration will lower the temperature of the gases and add to the work of the fan.

What is the heat loss through a wall composed of 9-inches of fire brick and 4 ft. ½ in. of silocel brick with a temperature of 1400 deg. F. in the flues and an air temperature of 80 deg. F.

$$Q = \frac{t_s - t_a}{\frac{x_1}{k_1} \quad \frac{x_2}{k_2} + \frac{1}{a}}$$

$$Q = \frac{1400 - 80}{\frac{9}{11} + \frac{4.5}{.74} + 0.5}$$

Q = 17.8 B.t.u. per hr. sq. ft. loss.

Where t_s = 1400 deg. F.
t_a = 80 deg. F.
x_1 = 9 in. of fire brick
k_1 = 11.0 B.t.u. per sq. ft. per hr., etc.
x_2 = 4.5 in. of Sil-O-Cel
k_2 = 0.74 B.t.u. per sq. ft. per hr., etc.
$\frac{1}{a} = 0.5$

Common brick is frequently used for the outer casing. It has the advantage of low cost, but is troublesome to maintain in an air-tight condition. The wall must be coated with a plastic seal and must be watched for cracks and checks which will allow leakage. Concrete walls if well reinforced in both directions and made of a dense mixture will give good results. If the wall is porous it must be coated in the same manner as a brick wall. Steel plate casing is probably the most satisfactory as it may readily be constructed with joints adaptable for thorough sealing, and once properly sealed will give little trouble.

Dampers are required for the direction of the gases in the flues. With a range of temperatures from 900 to 1500 deg. F., three general types of dampers have been developed with numerous modifications. These dampers assume quite larger proportions; 10 ft. by 10 ft. openings are not exceptional.

The most satisfactory arrangement for operating dampers of this size is to slide them vertically in slots in the brickwork. The water-cooled damper is made by spacing two steel sheets from two to six inches by a continuous bar bent to conform with the outer edge of the damper. The flat surfaces are staybolted to prevent bulging. Water is introduced through a flexible connection to a passage leading to the bottom. An overflow connection at the top insures that the damper is full at all times. The discharge should be open to the atmosphere as the steam emitted will furnish a warning to the operator in case of stoppage of water flow. The water for this type of damper should be free from scale-forming material.

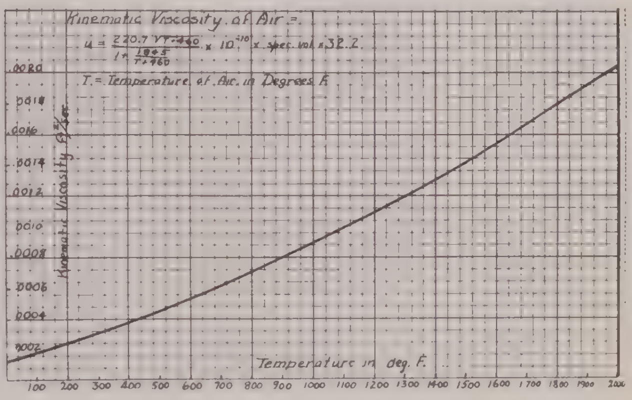


Chart No. 3

Another type of damper is made with a cast iron frame filled with fire brick or Sil-O-Cel concrete. The metal is not exposed to the gases but protected by the material.

A third type is composed of a number of small plates of heat resisting metal bolted together in such a manner as to prevent warping. A double layer of plates insures against gas leakage and the construction is designed for low cost and ease of replacement in case of damage.

The general designs of the stacks and fans for this work will follow good practice for boiler work. Where the dust has been removed in the flues, any good fan designed for hot gases will be satisfactory. If the dust is a serious factor the wear will be very rapid on the fan runner and casing and the simpler designs at low speed will be advisable.

Chapter III, "Instruments and Methods of Control," will appear in the December issue.

MEN and MILLS

Notes from the Field

Yosemite Increases Stock Issue to Build New Mill

Word has been received that documents covering an increase in the authorized stock issue of the Yosemite Portland Cement Company have been filed in Fresno, Calif. The authorized stock issue of the corporation is increased from 250,000 shares divided into 200,000 shares of Class A common and 150,000 shares of Class B common stock, each having a par value of $10. This increased capital is partly to pay for the construction of a new mill near Merced, having a daily output of 2,000 barrels of cement, at an estimated cost of $1,250,000. The common and preferred stock were offered to the public in March, 1925, at $10 a share and $100.

Canadian Cement Shipments Show Good Advance

Shipments of cement from Canadian mills in 1925 showed an appreciable advance over the total recorded for the previous twelve months, according to finally revised statistics issued by the Mining, Metallurgical and Chemical branch of the Dominion Bureau of Statistics of Ottawa. Sales during 1925 totalled 8,116,597 barrels, valued at $14,046,704, as compared with 7,498,624 barrels at $13,398,411 shipped in 1924.

In 1925 Ontario was the leading producer, sales in that province amounting to 3,462,358 barrels, valued at $5,253,911. While slightly below the total quantity for Ontario, sales from Quebec mills amounted to 3,365,802 barrels. British Columbia mills sold 485,185 barrels for $1,151,344, and Manitoba came next with 407,395 barrels worth $1,037,929. Alberta sales totalled 395,857 barrels at $913,529.

By provinces, the average selling price per barrel, f.o.b. plant, was as follows: Quebec, $1.59; Ontario, $1.52; Manitoba, $2.55; Alberta, $2.31; and British Columbia, $2.37.

Importations during 1925 amounted to 21,849 barrels averaging $2.89 per barrel as against an average of $2.50 in 1924. Exports of portland cement totalled 997.915 barrels invoiced at $1,498,495.

The total capital employed by the seven firms operating in the cement industry during 1925 was $38,081,583. Employment was furnished 105 salaried employees and 1821 wage earners; their combined earnings amounted to $2,511,400. Fuel and electricity costs totalled $2,848,904, made up of $2,229,065 expended for fuel, and $619,839 for electric power.

Jacobsen Leaves P. C. A. to Enter Employ of Bates Valve Bag Co.

H. G. Jacobsen, for many years manager of the Accident Prevention and Insurance Bureau of the Portland Cement Association, leaves his former connection November 1 to enter the employ of the Bates Valve Bag Company of Chicago.

Under Mr. Jacobsen's direction the accident prevention work of the cement industry has attained the enviable position it now holds. It is due largely to his efforts that the present complete organization for accident prevention in the individual mills is functioning so efficiently.

Friends and co-workers of Mr. Jacobsen will be glad to learn that he will continue in the cement industry as an employee of the Bates Valve Bag Company in sales and service work. He will be glad at all times to continue to do all in his power to carry on the work in accident prevention in cement mills.

Swedish Cement Men Form New Association

Swedish cement manufacturers have organized an association, known as the Svenska Cementforeningen, the object of which is to promote the use of cement and concrete construction in that country, reports Commercial Attache Klath at Stockholm, to the Department of Commerce. To increase the popularity of cement the association will spread appropriate advertising and give technical advice free of charge. It is expected in Sweden that the association will have a successful future and that concrete construction will increase especially in country districts where many buildings and bridges await modernization. All costs incurred by the association will be paid by the member manufacturers.

International Mill in New Orleans is Nearing Completion

The new mill of the International Cement Corporation in the city of New Orleans is nearing completion. The 250-foot concrete stacks are now up, fourteen months after work was started, and soon all construction will be completed and machinery installed.

New Swiss Cement Standards Adopted

A new standard specification for cement was promulgated in Switzerland on January 1, 1926. Three types of cement were recognized: portland cement, high early strength portland cement, and high alumina cement.

The minimum strength of portland cement briquettes, after curing under water, has been fixed as follows:

Tensile Strength
7 days, 283 lb. per sq. in.
28 days, 397 lb. per sq. in.
Compressive Strength
7 days, 3263 lb. per sq. in.
28 days, 4611 lb. per sq. in.

Special cements of high early strength will be known in the future as "Ciments a hautes resistances (cements of high strengths). They are separated into two classes according to their chemical composition, as follows:

1. Portland cement of high strength
2. Aluminus cement or cement fondu

Portland cement of high strength has the same chemical composition as ordinary cement: It differs only in the special preparation of the raw materials and in the more intense burning.

The standards prescribed for ordinary portland cement hold equally good for portland cement of high strength, with the exception that the requirements for tensile strength and compressive strength are increased.

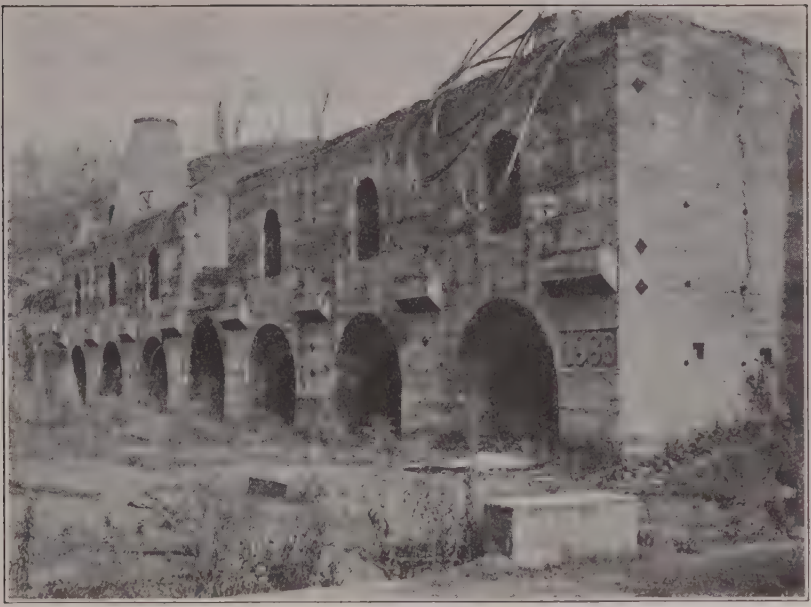
In order to allow for the special conditions under which cements of high strengths are used, the briquettes manufactured and cured under the same conditions as ordinary portland cement must show the following minimum strengths:

At 3 days 397 lb. per sq. in. tensile strengths; 4615 lb. per sq. in. compressive strengths.

At 7 days 496 lb. per sq. in. tensile strengths; 7095 lb. per sq. in. compressive strengths.

At 28 days 567 lb. per sq. in. tensile strengths; 9223 lb. per sq. in. compressive strengths.

Mr. J. Nold, a member of the executive staff of the United States Gypsum Company in Chicago, recently visited the quarries of the Canadian Gypsum Company at Wentworth, N. S., Canada.



Some of the old dome kilns of the original "American mill," now part of the property of the Giant Portland Cement Company, Egypt, Pa. It required 7 days to make a barrel of cement with the old dome kilns. Each time a kiln was emptied, it provided enough clinker for from 150 to 200 barrels of cement. Only a 50-mesh sieve was used and if 95 per cent of the cement passed through this screen, it was considered fine cement

New Egyptian Declares Dividends

E. R. Sullivan, vice-president of the New Egyptian Portland Cement Company, has sent out a statement to the effect that the Board of Directors, at a meeting in Detroit on September 20, declared the regular quarterly dividend of 1¾ per cent on the 7 per cent preferred stock and the regular quarterly dividend of 40 cents per share on the no par value common stock, to stock of record on September 24, and payable October 1.

Georgia Portland Considering New Plant

The construction of a $3,000,000 cement plant near Sandersville, Georgia, is planned by the Georgia Portland Cement Company. Machinery has been purchased and will be installed as rapidly as possible. Reports indicate that the capacity of this plant will be between 3,000 and 5,000 barrels daily.

Allan FitzRandolph Will Probated

The will of the late Allan H. FitzRandolph, president and general manager of Randolph & Baker, Limited, Randolph, N. B., lime manufacturers, disclosed an estate valued at $135,461.

The executors of the estate are instructed by the testator to sell the real estate owned by him, the proceeds to be invested in securities. G. A. FitzRandolph has succeeded his father as head of Randolph & Baker, Limited.

He Started as a Newspaper Man

Those who know Richard K. Meade would be interested in a short story on his life that appeared quite recently in the *Syracuse Journal* (N. Y.) According to the writer in that paper, Mr. Meade took journalism as his first activity upon graduating from the University of Virginia, when he was but 20 years old. He was made editor, at that time, of the *Independent-Herald* of Hinton, Va. At the end of a year, however, he realized that chemistry was more to his liking, and accepted a position with the Longdale Iron Company. After two years of this he went to Lafayette College as an instructor in chemistry.

He was 28 years old when he obtained the position of Chief Chemist for the Edison Portland Cement Company. A year later he went with the Northampton Portland Cement Company, and the following year he went with the Dexter Portland Cement Company in a similar position. It was about this time that he founded and became the editor of a trade paper known as the *Chemical Engineer*. Later he was director of the Meade Testing Laboratories in Allentown, Pa., and then General Manager of the Tidewater Portland Cement Company, following which he established his present business as consulting engineer.

Fairport Harbor Plant of Standard Shows Activity

The Standard Portland Cement Company of Cleveland, of which T. R. Evans is president, reports that the new plant erected at Fairport Harbor, near Painsville, Ohio, in 1925, is carrying on a high rate of production to keep in step with the good business in its territory. Shipping cement since September of that year, the million barrel capacity of the plant has proven to be not far ahead of the requirements. Standard Cement is being used in a great many important Cleveland projects, and some is being shipped to other parts of the normal territory. Projects in Cleveland utilizing this brand of cement include the Union Terminal Building, the Halle Brothers Company Annex, the new Willard Storage Battery Company Building, the Kenmore telephone exchange, the new McKinney Steel Company plant, the W. S. Tyler Company Building, roadbeds and bridges of the Nickel Plate, New York Central, and Baltimore & Ohio railroads, and three schools.

Burrell Company Undertakes New Contracts

The Burrell Engineering and Construction Company of Chicago have been awarded contracts for the construction of two batteries of raw material bins for the Lehigh Portland Cement Company. The first of these, a group of 16 bins, 14 ft. 9 in. with head house, will be constructed at the Fogelsville plant and the other group, also of 16 bins, will be built at the West Coplay plant.

Arvid L. Frank Leaves Dewey to Sell Motor Cars

Arvid L. Frank, vice-president and sales manager of the Dewey Portland Cement Company, has resigned that position and a directorate in the Liberty National Bank to enter the export sales department of the Studebaker Corporation, motor car manufacturers. Mr. Frank has already entered upon his new duties in New York City. He has been succeeded by Walter Gray, formerly assistant sales manager at the Oklahoma City plant of the Dewey company.

New Kiln Sheds Being Erected at Cementville, Texas

The San Antonio Portland Cement Company, San Antonio, Tex., have let contracts for the erection of kiln sheds at their Cementville plant. The Houston Structural Steel Company, Houston, Tex., will take care of the structural steel work, while the sheet metal work has been awarded to the Eagle Sheet Metal Works, of San Antonio. W. E. Simpson & Co., of San Antonio are the engineers.

Interesting Facts Told at German Cement Meeting

Aluminous Cements, Water-Jacketed Kilns, Pressed Carbon Kiln Lining Among Subjects Covered

When the German Association of Portland Cement Manufacturers met in Hanover, Germany, on September 8 to 10, prominent producers of cements made interesting statements in their papers that showed important advances in manufacturing processes. Aluminous cements came in for quite a bit of discussion. Dr. K. Biehl, in the course of his paper, spoke of two types of kilns used for the manufacture of that material; the rectangular to round water-jacketed kiln, and the electric furnace with water-cooled carbon electrodes. Since neither combined all desired advantages, in his opinion, he suggested that an eventual development might bring about a new kiln that would be a combination of the two types. Pressed carbon is used for kiln linings. The fusion effect in both kilns is that of reduction, part of the iron oxide is reduced to iron in the water-jacketed kiln, and a part of the silica is reduced to silicon, in the electric furnace. The latter process yields a valuable by-product—ferrosilicon. The first type of kiln treats 30 to 50 tons of raw material a day, while the electric furnace treats 10 to 15 tons. The water-jacketed kiln has a fuel consumption of 25 to 30 per cent of the fused cement, while the electric furnace requires 1.5 k.w. for each kilogram of cement. The hydraulic modulus of aluminous cement is 0.5 to 1.0, against 1.7 to 2.2 for the best portland. The silica modulus is 0.1 to 0.3 against 1.2 to 4.0 for portland. A thin section of aluminous cement shows large crystals. These are penta calcium aluminate and tricalcium aluminate. The setting and hardening process of aluminous cements proved interesting. The speaker said that three hours after the formation of the calcium hydroaluminate (formed in the setting process) there appears tricalcium aluminate plus water. After three hours a turbidity appears which is probably due to colloidal aluminum hydroxide. After three to four weeks these gelatinous drops form crystals. Since no free calcium hydroxide is liberated in the hardening process the aluminous cements are not harmed by sea water. The resistance of this cement to acids is higher than the resistance of other cements. Attention was called to the fact that aluminous cements are used quite the same as portland cement.

Following this interesting paper Dr. Haegermann compared German testing methods with the methods and specifications followed in England. He pointed out that there is a great difference in sieves and that the cements from the two countries did not coincide in fineness. Dr. K. Endell discussed the effect of high temperatures on the hardened cement, aggregates, and concrete. He cited tests that show loss of loosely combined water at 100 degrees, a loss of water combined as calcium hydrate at 530 degrees, and a further slow loss of water from other compounds in the cement beginning at 1,000 degrees. Water cured cement showed less contraction under exposure to heat in excess of 100 degrees than did cement cured under other conditions. Quartz, granite, basalt and blast furnace slag aggregates were observed under high temperatures. The first two showed marked expansion up to 500 degrees and then a cracking that showed alteration from alpha to beta quartz. The other two performed better. Therefore, in concrete to be exposed to heat, it is advisable, he said, to use aggregates composed of basalt, blast furnace slag, and limestone, and avoid the use of the quartz-containing mixtures.

Next, Dr. Kuhl discussed the laboratory testing of cement and described the use of a test sample 3 cm. long and 1 cm. cross section, tested as a beam. Dr. Schott then presented the report of the kiln commission. This report told of the Stehmann cooler in wet process kilns, and demonstrated the possibilities of the recovery of more heat from clinker by means of a special process.

Rudolf Grimm spoke on the mixing of cements and stated that it is probable that potassium aluminates are the cause of rapid setting and are dissolved in the Alite, Belite, etc.

McConnell Becomes Vice-President of North American

Mr. Loring A. Cover has relinquished the office of vice-president of the North American Cement Corporation, but continues as director, according to an announcement emanating from the office of the president, Mr. F. W. Kelley. Mr. Luther G. McConnell becomes vice-president to fill the vacancy. Mr. Frederick A. Boeye has been appointed General Sales Manager. These changes were effective on September 1.

The resignation of Mr. Cover from his office as vice-president is in accordance with wishes that he expressed at the time of the formation of the company, after one year of service with the new organization.

C. H. Peters' Sons, operating lime quarries at Terryburn, N. B., Canada, known as the Clairmont Lime Quarries, have completed improvements to the plant and the buildings. A new siding has also been built along the Canadian National Railways. The railroad is within a few yards of the plant.

St. Joe Lime Plant Being Rebuilt and Enlarged

Less than two months ago the lime plant of the St. Joe Lime and Stone Company, St. Joe, Ark., was destroyed by fire. Within three weeks the work of rebuilding the plant was begun and lime produced in one kiln which was first repaired. The mill, cooperage department, storage sheds, and other buildings are being replaced. John O. Wilson, general manager, has announced that another large kiln will be constructed to provide for the increased demands of the new hydrating plant now being installed. Everything in the latter plant will be electrically operated. A new ledge is being opened in the quarry and new track being laid from this ledge to the plant. Work will all be completed by the first of November and the plant in full operation by that date.

British Organization Orders New Vessels

Very heavy orders for equipment have recently been placed in the United Kingdom by the Cement Marketing Company of London. The most important orders are for a tug, a considerable number of lighters and canal barges, and a motor barge. The orders have been distributed between several British concerns.

New Cement Laboratory Established at Grenoble

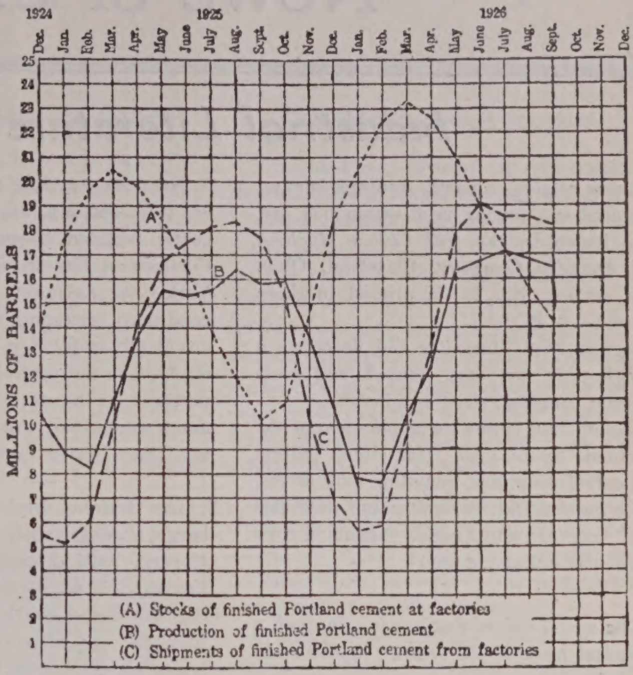
As long ago as 1912 Mons. Marius Viallet, president of the chamber of commerce of Grenoble, France, undertook to organize at the Polytechnic Institute of Grenoble a laboratory for research work and tests of metal, lime and cements. During the period of the war the project was temporarily dropped, but the war furnished such a forceful illustration of the necessity and utility of such an institution in the industrial center, of which Grenoble is the capital, that in 1918 new plans were discussed and a new campaign launched.

In 1919-1920 a subscription was opened among the business men and firms of the region which brought in the sum of 100,000 francs. At the same time the public authorities granted large subsidies which permitted the organizers to realize their projects.

The laboratory, which is located at 46, Avenue Felix-Viallet, Grenoble, is now fully equipped with all of the modern appliances and equipment necessary for all researches and tests pertaining not only to all metals and minerals but also all tests pertaining to lime, cement and concrete of any form.

Cement Statistics for September

SEPTEMBER production and shipments were the highest for that month in the history of the industry, showing increases of 4 and 2 per cent respectively, over September, 1925, according to the bureau of mines, department of commerce. During the nine months ending September 30, 1926, the shipments of portland cement amounted to 126,467,000 barrels, exceeding the shipments for the corresponding period in 1925 by 2,156,000 barrels. Portland cement stocks decreased but at the end of September, 1926, were greater by more than 38 per cent than on September 30, 1925.



Estimated Clinker (Unground Cement) at the Mills at End of Each Month, 1925 and 1926, in Barrels

Month	1925	1926
January	7,017,000	9,074,000
February	9,497,000	10,931,000
March	9,962,000	12,284,000
April	9,731,000	12,934,000
May	9,053,000	11,649,000
June	7,937,000	10,086,000
July	6,961,000	8,515,000
August	5,640,000	*7,362,000
September	4,561,000	6,095,000
October	4,086,000	
November	5,013,000	
December	6,469,000	

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*Revised.

Production, Shipments and Stocks of Finished Portland Cement, by Months and by Districts

Month	Production 1925	Production 1926	Shipments 1925	Shipments 1926	Stocks at End of Month 1925	Stocks at End of Month 1926
January	8,856,000	7,887,000	5,162,000	5,674,000	17,656,000	20,582,000
February	8,255,000	7,731,000	6,015,000	5,820,000	19,689,000	22,384,000
March	11,034,000	10,355,000	10,279,000	9,539,000	20,469,000	23,200,000
First quarter	28,145,000	25,973,000	21,456,000	21,033,000		
April	13,807,000	12,401,000	14,394,000	12,961,000	19,877,000	22,640,000
May	15,503,000	16,472,000	16,735,000	17,951,000	18,440,000	21,173,000
June	15,387,000	16,827,000	17,501,000	19,113,000	16,409,000	18,900,000
Second quarter	44,697,000	45,700,000	48,630,000	50,025,000		
July	15,641,000	17,096,000	18,131,000	18,786,000	13,896,000	17,210,000
August	16,419,000	16,936,000	18,383,000	18,536,000	11,952,000	*15,718,000
September	15,939,000	16,571,000	17,711,000	18,087,000	10,247,000	14,202,000
Third quarter	47,999,000	50,603,000	54,225,000	55,409,000		
October	15,992,000		15,309,000		10,979,000	
November	13,656,000		10,187,000		14,534,000	
December	10,713,000		6,917,000		*18,515,000	
Fourth quarter	40,361,000		32,413,000			
	161,202,000		156,724,000			

*Revised.

Commercial District	Production—September 1925	Production—September 1926	Shipments—September 1925	Shipments—September 1926	Stocks at End of Sept. 1925	Stocks at End of Sept. 1926	Stocks at end of Aug., 1926*
Eastern Pennsylvania, New Jersey, Md.	3,685,000	3,936,000	4,428,000	4,593,000	1,048,000	2,718,000	3,375,000
New York	910,000	948,000	1,072,000	1,194,000	465,000	596,000	842,000
Ohio, Western Penna. and W. Virginia	1,620,000	1,797,000	1,905,000	1,903,000	1,232,000	1,930,000	2,036,000
Michigan	1,087,000	1,415,000	1,245,000	1,614,000	716,000	1,062,000	1,261,000
Wisconsin, Illinois, Indiana and Kentucky	2,403,000	2,326,000	2,697,000	2,451,000	1,828,000	1,799,000	1,925,000
Virginia, Tennessee, Alabama and Georgia	1,289,000	1,368,000	1,341,000	1,428,000	271,000	1,029,000	1,089,000
Eastern Missouri, Ia., Minnesota and S. D.	1,591,000	1,470,000	1,781,000	1,556,000	1,890,000	1,993,000	2,078,000
Western Mo., Nebr., Kansas and Okla.	1,122,000	1,046,000	1,055,000	970,000	1,498,000	1,407,000	1,331,000
Texas	399,000	437,000	372,000	438,000	288,000	417,000	418,000
Colorado, Montana and Utah	245,000	247,000	236,000	288,000	417,000	384,000	425,000
California	1,223,000	1,272,000	1,199,000	1,318,000	451,000	458,000	504,000
Oregon and Washington	365,000	309,000	380,000	334,000	143,000	409,000	434,000
	15,939,000	16,571,000	17,711,000	18,087,000	10,247,000	14,202,000	15,718,000

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*Revised.

News of the Industry

Industrial Literature

A new catalog on power transmission and pertinent engineering information has just been issued by the *Hill Clutch Machine and Foundry Company,* Cleveland, Ohio. This catalog, No. 26, is printed in three sections—A, B and C.

Section 26-A illustrates and describes a new flexible coupling, flanged and compression coupling, shaft and bearings.

Section 26-B covers the application of the patented *"Smith Type" Hill* clutch pulleys and cut-off couplings, including quill drives, while Section 26-C illustrates and describes both American and English systems of rope drives and agitator designs.

The new *Timken Engineering Journal,* a loose-leaf book of 110 pages, contains technical information relative to the application of *Timken* bearings to industrial and automotive machinery. Typical problems, and solutions, involving the calculation of various loads and the selection of suitable bearings are given. Tables showing bearing ratios, capacities, and dimensions, as well as speed capacity-curves are included.

A full set of dimension sheets accurately drawn to scale, together with formulas and recommendations for the application of bearings comprise another section.

Copies may be had by writing the *Timken Roller Bearing Company* at Canton, Ohio.

"Automatic Pumping" is the title of a new, 24-page booklet issued by *Barrett, Haentjens & Co.,* Hazelton, Pa. The subject is treated from a purely technical standpoint and several new methods of making centrifugal pumps automatic are described. Copies may be secured upon request.

The *Mueller Steam Specialty Company, Inc.,* New York City, announces the publication of its catalog, *No.* 22. This publication describes and illustrates the steam, water, air, oil and gas specialties produced by the firm.

For the user of industrial chain drives, the *Boston Gear Works,* Norfolk Downs, Mass., has published a catalog of related products, compactly assembled in 36 pages. Sprockets and chains, chain drives and lubricators are among those cataloged and typical applications shown.

The *Coxe* traveling grate stoker, for boilers from 150 h.p. up, is featured in a recently received 16-page booklet from the *Combustion Engineering Corporation,* New York City. According to the literature, the conditions necessary for good combustion are ideally fulfilled in the *Coxe* stoker. Particularly is the control of air supply to all portions of the grate surface stressed. A dozen and a half side, detail and installation views furnish excellent illustrations.

The *Andrews-Bradshaw Company,* Pittsburgh, Pennsylvania, has just prepared a 48-page, fully illustrated catalog on the *Tracyfier.* It covers the necessity for cleaning steam and the benefits to be derived from the use of steam entirely free from boiler water or dust. The construction of the *Tracyfier* is clearly shown, the catalog including as well a discussion of the effect of boiler water treatment and blow-down on steam quality.

Citing three examples of cases where impurities occurred in steam in cement plants, *Bulletin 34* of the *Andrews-Bradshaw Company,* Pittsburgh, suggests the use of the *Tracyfier* for obtaining clean, dry steam.

A booklet devoted entirely to its H. S. fans has been published by the *American Blower Company,* Detroit, Michigan. The fan is designed for forced draft work, where large volumetric capacities and relatively high pressures are necessary. The catalog contains curves showing the characteristics, specification sheets, capacity tables and detailed dimension sheets, as well as illustrations of the parts.

Bulletin No. 103 of the *Celite Products Company* contains descriptions of the four types of *Sil-O-Cel* insulating brick, their application, and details of laying. The other half of the booklet is devoted to *Sil-O-Cel* insulating mortar, *Celcote* brick coating, and *Fraxite*—a high temperature cement for brick joints in refractory equipment. A list of other bulletins on related subjects is given.

A brick having low repair expense and longer refractory life is the subject of the broadside received from the *Ashland Fire Brick Company,* Ashland, Kentucky. Four excellent illustrations show two installations, the actual size of the brick, and a view of the *Ashland* checkers.

With the Manufacturers

Timken Exhibit Attractive at Chicago Tool Show

Perhaps one of the most outstanding displays at the National Machine Tool Exposition held on the Municipal Pier at Chicago recently was that of the *Timken Roller Bearing Company* of Canton, Ohio. This company occupied two adjoining spaces, in one of which was shown an unique display of the *Timken* bearings and in the other a miniature model of the *Timken* steel plant.

In the foreground of the bearing booth was a table on which was arranged a varied assortment of bearings, ranging in size from one inch to 24 inches. In the second booth a 14-foot miniature of the steel plant was exhibited, built to the scale of 1 inch to 10 feet. Electric furnaces, tube mills, wire mills and all other equipment was shown in detailed miniature.

Mr. J. M. Allen has recently joined the factory organization of the *Foote Bros. Gear & Machine Company* as manager of production.

During the World war Mr. Allen was in the ordnance department of the U. S. army as accountant in charge of field artillery construction, and after the armistice served a year as a member of the staff of the claims board. Subsequently, he was manager of production of the Mosler Safe Company, Hamilton, Ohio, and manager of production and traffic for the Goldsmith Metal Lath Company, Cincinnati, Ohio.

A new branch office has just been opened in Utica, N. Y., at 107 Foster Building, 131 Genesee Street, by Link-Belt Company of Chicago, Philadelphia and Indianapolis.

This, their thirty-fourth office, and the third within the state of New York, is to be devoted especially to the sale of Link-Belt silent chain and Link-Belt roller chain, and will be in charge of Mr. F. P. Hermann, Jr., who has had many years of silent chain experience and contact while located in the New York office of the company.

Mill Equipment

The Fahrenwald Sizer

The Dorr Company, engineers, New York City, has recently announced that it has taken over the manufacture and sale of the Fahrenwald Sizer, an hydraulically operated machine that was developed after a long series of tests by A. W. Fahrenwald of the U. S. Bureau of Mines.

The sizer is new in the field of hindered settling classification, the applications being summed up as follows: It will take an unsized feed in which the particles are of uniform specific gravity and deliver a number of closely sized products, or, an unsized feed in which the particles are not of uniform specific gravity, according to specific gravities, delivering a series of hydraulically classified products. The sizer will also take a sized feed in which the particles are not of uniform specific gravity, and separate the particles according to specific gravities.

The sizer is a six-pocket machine, the compartments having straight, non-sloping sides so that the velocity of the hydraulic water is uniform over the whole area. The spigot discharge valve is controlled by a diaphragm, sensitive to every change of conditions in the classifying pockets, insuring uniform quality of the spigot products.

New Coal-Burning Equipment

The *Pulverzone*, a new type of apparatus, combines in one device three methods of burning coal—pulverized coal burning, the spread method, and the coking method. It is able to burn the smaller lumps and fines in suspension as with powdered coal burning. The heavier coal falls down at the front while the intermediate sizes are automatically spread over the rear section of the fuel bed.

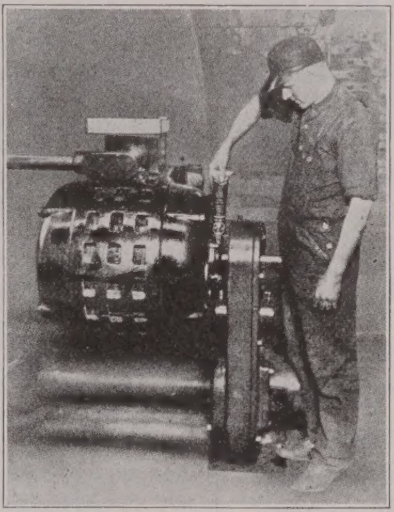
The necessity for pulverizing the coal or drying it is eliminated by an ingenious method. The *Pulverzone* is capable of maintaining 12½ to 14½ CO_2 at ratings of 350 per cent of boiler capacity, and can be installed on all return tubular and water-tube boilers from 50 up to 2,000 h.p. The overloads are possible because of the complete ignition of the volatile, the intimate mixing of oxygen and gases and the partial combustion of the small coal in suspension.

The device is being marketed by the *CoKal Stoker Corporation*, Chicago.

Wasteless Grease in Tubes

Annual lubrication of motors is reduced to a 20-minute job by the use of the proper grease in collapsible tubes, each containing just enough for a motor's yearly requirements.

After flushing out the old grease with kerosene as directed in printed instructions supplied with the tube, the new grease is squeezed from the tube directly into the bearing. The directions show just how much to put into each bearing. Four sizes of tubes are available for corresponding sizes of bearings.



The manufacturers, Fairbanks, Morse & Co., Chicago, claim the many advantages of tube-greasing offset the slight additional cost by the elimination of waste of grease. The kind of grease best adapted for ball-bearings is used. It is of the proper adhesiveness to cling to the balls, maintaining its consistency through all normal temperatures without being too stiff when starting in the cold, or melting and flowing out of the bearing when running at full load.

All classes of material are handled without passing through the wheel or around the housing by the exhaust fans manufactured by the Connecticut Blower Corporation, Hartford, Conn. They are of the slow-speed, low horsepower, high efficiency type and are adjustable and reversible, each fan combining over thirty ordinary types.

They may be placed on the floor or suitable foundation or reversed and bolted direct to overhead timbers, eliminating the cost of a platform. The discharge outlet may be adjusted to point in any desired direction at will.

The Minogue Agitator

A decided step forward in slurry agitation efficiency is realized by the use of the Minogue agitator, consisting of a simple device supported on a structural framework suitable for any size tank. Agitation is obtained through two arms provided with lifting teeth and air pipe, revolving continuously in the bottom of the slurry tank.

The feed pipe for air leading to the governor valve has in it for a short length a very small diameter pipe, about ⅜ in., depending on the size of tank.

The feed pipe itself is 1½ in. The constricted area limits the amount of air consumed yet at the same time provides for building up the pressure to the compressor capacity should it be required.

A distributing valve furnished the full supply of air for a complete revolution to each of the pipes in its proper sequence. This overcomes the usual trouble from the pipes plugging and insures that the air released is in a definite position.

The Minogue agitator is a product of the Manitowoc Engineering Works, Manitowoc, Wis.

Small Aggregate Crusher

To cope with the demand for concrete aggregates in small sizes up to 1-inch ring, the Traylor Engineering and Manufacturing Company recently introduced the Bulldog finishing gyratory crusher, in four sizes.

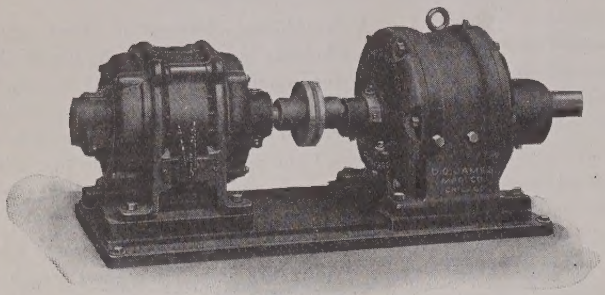
It is an oversize machine, extra heavy for the size of its receiving opening. The top shells are shorter than the corresponding sizes of standard Bulldogs employ, enabling the use of shorter heads and therefore heads of larger diameter, as related to the receiving opening, for the purpose of securing a more favorable crushing angle and a greater discharge opening.

Speed Reducers Operate Patented Capstan

Modern speed reduction methods were applied in securing the desired speed on the capstan of a Mississippi river boat by the use of an outfit developed by the Laclede Iron Works of St. Louis, Mo. The device is known as the Laclede Iron Works Patented Capstan, used for raising and lowering the anchor or lightening up on guy ropes.

JAMES

Speed Reducers



THE GO-BETWEEN

Heavy equipment to drive. Light weight, high speed electric motors to drive it. And, in between, an important factor, the speed reducer which makes such power drives possible.

The James Spur Gear Speed Reducer is the ideal connecting link between motor and machine. Long-lived, trouble-free, with constant efficiency built in, James Speed Reducers can be relied upon for satisfactory service.

They are unaffected by heat, dust, acid gas or other conditions injurious to the average speed reducer. James Reducers stand the test of time.

Let us tell you more about them.

A complete line of Chain Belts, Wood's Power Transmission Appliances, Fafnir Ball Bearings, Chicago Automatic Conveyors, D. O. James Speed Reducers, Whitney Silent Chain Drives.

Philadelphia Branch
CHAIN BELT COMPANY

ROBERT L. LATIMER & CO.
24 to 28 N. Front St. Philadelphia, Pa.

Great Lakes Plant

(Concluded from page 95)

From the raw mills the slurry is pumped by means of Wilfley centrifugal slurry pumps to the concrete slurry tanks. There are twelve of these, each 15 feet in diameter and 40 feet high. Here corrections in proportioning are made if necessary, before the slurry is again conveyed by Wilfley pumps to the large, 6,000 barrel slurry basin, located under the kilns.

Kilns

From the storage basin, the slurry is pumped to four straight kilns, 11 feet in diameter by 250 feet long. The clinker discharges from the kilns into four 9 by 90 ft. coolers located directly under the kilns. Both the kilns and the coolers were made by Reeves Bros. of Alliance, Ohio. Each kiln has a concrete stack, ten feet in diameter and 225 feet high. Dust collecting chambers are provided between the stacks and the kilns.

The only bucket elevator in the plant, a Chain Belt pivoted bucket, takes the clinker from the cooler discharge and delivers it to the bins over the finish grinding mills. These are of the same type as the raw bins and are also located directly under the elevated service track. There are four bins for clinker and four for gypsum directly above the finish mills. Gypsum, as was previously described, is dumped into the bins above the finish grinding mills directly from the railroad cars.

Finish Grinding

Four 8 by 30 ft. Allis-Chalmers three-compartment compeb mills grind the clinker. A Fuller-Kinyon installation then conveys the cement to the storage silos. There are sixteen of these, each 33 feet in diameter and 80 feet high, providing storage for 350,000 barrels of finished cement.

The packhouses, as previously described, provide for both rail, truck and lake shipment.

Coal Room

Coal storage 200 by 8 feet has been provided, but during average operating conditions, the coal will be shipped in gondolas, elevated to the overhead service track and discharged directly into the bins over the coal mill.

From these bins the coal is fed down through four Fuller-Lehigh waste-heat dryers into coal mills supplied by the Raymond Brothers Pulverizer Company. The coal is then carried by air to separators and discharged into screw conveyors that carry it over the bins that supply the kilns. All coal is used for burning in the kilns as power is purchased from the Buffalo General Electric Company at the low rates prevailing in that locality.

Auxiliary Buildings

Auxiliary buildings also are of reinforced concrete construction. There is a 200 by 50 ft. machine shop and storeroom, an electric shop, a transformer house, a change house for the men and a combined office and laboratory building.

Personnel

The new plant was designed by the officials of the Great Lakes Portland Cement Corporation, who worked out their ideas in plant design in the layout. The Burrell Engineering and Construction Company are the contractors on the plant buildings, the Weber Chimney Company are building the kiln stacks and the company's forces are installing the equipment. Officers of the Great Lakes Portland Cement Corporation are: Adam L. Beck, president; M. H. Hammond, vice president; Marshal Beck, secretary and treasurer; J. B. Zook, chief engineer; A. T. Bevier, superintendent, and W. S. Morrison, traffic manager.